THE DRY COLLODION PROCESS;

BY

ROBERT F. BARNES.

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INTRODUCTION.

In bringing the Dry Collodion Process before the Photographic Public, I may be allowed, in justice to myself, to state that, as early as October, 1854, I succeeded in producing negatives upon dried collodionized plates; but being aware that many others, besides myself, were engaged in pursuit of the same object, and imagining that I should not, therefore, be the first to discover a simple and easy method of obtaining pictures upon dessicated collodion, I only carried on my experiments at my leisure.

In the spring of last year I employed all my spare time in making further investigations; the subject proving an exceedingly interesting one, and calculated in my mind to lead to some very curious results.

I found there were a variety of ways of accomplishing the end I had in view, and I was induced by the extreme beauty, joined with wonderful facility of manipulation, of many of the methods, to carry out a much larger series of experiments than I had originally intended. Details of many of these trials will be given in the latter part of this work; but I shall confine myself, in

the body of it, to a description of that process which ensures the best results, and which combines, at the same time, economy with facility of manipulation.

The whole of my experiments were made upon glass plates, 10 in. by 12 in. My principal object was to overcome the great difficulties resulting from the use of large surfaces covered with collodion—difficulties caused by the varying contractibility, or expansibility, of different specimens of collodion when re-wetted previous to, and during, the development of the picture; besides, I well knew that if I succeeded with large-sized plates, success with the use of the smaller sizes would follow as a matter of course.

Although these impediments no longer exist, I should still recommend the beginner to practise upon plates 10 in. by 8 in. or even smaller, as he may at first expect to have to contend with obstacles (almost always attendant upon those who practise a new process) which may prejudice him against my method, but which will rapidly disappear by the exercise of a little patience and perseverance.

*** It was my intention to have issued this pamphlet in July last, but ill health compelled me to abandon my photographic pursuits for several months, and prevented me, also, from producing many specimens for the Exhibition this year.

May, 1856.

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THE DRY COLLODION PROCESS.

By ROBERT F. BARNES.

APPENDIX TO THE FIRST EDITION.

Since the publication of my pamphlet on the above subject, in the month of May of the present year, I have been carrying out a further series of experiments, in order, if possible, to render the process still easier to the tyro; and it will be my endeavour, in the following pages, to point out the modifications I have made in it. I had intended deferring the publication of these notes until the appearance of the Second Edition of "The Dry Collodion Process;" but as that will not be ready, I fear, until next spring (owing to the papers on the "Wet Collodion," and "Positive Printing" Processes, which will be embodied with it, not being quite completed); and as the process can be easily studied and carried out during the long winter's evenings, I thought the issuing, at the present period, of an Appendix, containing the principal alterations and improvements, would not prove unacceptable to the Photographic public.

I recommended, in my work, the use of Collodion alone, unsupported by any other substance, as most likely to prove successful in the hands of beginners. Since that time, however, I have found that almost in every case my pupils and others select, in preference, the process described at pages 25 and the following, as being the safer and easier plan.

There are certainly advantages attending the adoption of this method; there is not nearly as much danger of injuring the film during the operations of developing, fixing, washing, &c., as when simple Collodion is used; besides which, not only can a newly iodized Collodion be made use of, but almost any collodion—Thomas's especially, for instance—can be easily rendered fit for dry plates. I may mention, in order that I may not be charged with misleading the public, that all the different methods of obtaining pictures upon Dry Collodion being equally certain in my

hands, I advised the employment of Collodion alone as being, in my opinion, not only simpler in itself, but requiring less time in the preparation of the needful solutions, &c., and combining, also, economy with facility of manipulation.

It is sometimes rather difficult to obtain the albumen solution [page 28] perfectly clear; and the preparation of it invariably involves a considerable loss of time. I now proceed in the following manner—the resulting fluid is beautifully transparent, and entirely free from "floaters;" it also flows more readily over the plate:—

White of Egg	2 ounces.
Distilled Water	5 ounces.

Beat up in the usual manner; then add, previously mixed,

Glacial Acetic Acid	½ drachm.
Distilled Water	1 ounce.

Beat up again for a few minutes and allow to stand; in a very short time the liquid will become clear and sufficiently limpid to pass through ordinary filtering paper. It must, however, be previously strained through fine muslin, then filtered through bibulous paper; care being taken to pass it three or four times through the same filter, as, at the first filtration, fibrous particles are carried off the paper, and are to be found floating in the liquid.

The glass plates, when albumen is used, need not be ground at the surface as directed at page 7. They should be cleaned either with a solution of washing soda, or, better still, with a weak solution of cyanide of potassium, and, after abundant washing, be finally polished off with a little alcohol.

In the process of coating plates a large quantity of albumen solution should be poured on. By taking this precaution, any particles of dust, &c., will float on the surface and be carried off; whereas, were only a small amount to be used, they would be likely to adhere to the glass.

The coating of albumen is readily washed off the glass with a little water; after the plate has been excited, cyanide of potassium must be used to remove the film.

I have somewhat modified the method of iodizing the Collodion. The iodizing solution is prepared as follows:—

Solution No. 1.

Re-sublimed Iodine	1 drachm.
Absolute Alcohol	4 ounces.

When dissolved, add

Anhydrous Carbonate of Soda	1 drachm.

Pour or filter off the liquid, after remaining in contact with the soda about twenty-four hours.

Solution No. 2.

Iodide of Potassium, powdered	2 drachms.
Absolute Alcohol	2 ounces.

Allow these ingredients to be together, (shaking the bottle containin

them now and then) for about twenty-four hours. After the lapse of that period, add to them

Solution No. 1	4 ounces.
Pyro-acetic Spirit, purified	½ ounce.

In a few days the solution, from being of a deep red hue, will become pale and almost colourless. It is then fit for use; and it should, after filtration, be added to the Collodion to be iodized in the proportion of five drachms of the former to four ounces of the latter.

The Collodion is rendered more sensitive by the addition of two grains of Iodide of Ammonium to each drachm of iodizing solution.

Chloroform, also, used in the proportion of fifteen drops to each ounce of Collodion, greatly increases the sensitiveness of it.

It will be advisable to reduce the amount of camphor—half a grain, instead of one grain, being used to each ounce of Collodion; pyro-gallic acid alone can then be used, and the development of the picture will be quickened to a great extent.

The Ethereal Tincture of Chloride of Gold [page 8] is to be prepared as follows :—

Chloride of Gold	2 grains.
Iodized Collodion	1 ounce.

Dissolve, and then add

Anhydrous Carbonate of Soda	½ drachm.

Two drachms of the clear solution to be added to four ounces of Collodion.

From the foregoing observations, it will be gathered that the following formula must be substituted for that given at page 9 of the original work :—

Plain Collodion	4 ounces.
Iodizing Solution	5 drachms.
Pyro-acetic Spirit, purified	4 drachms.
Camphor	2 grains.
Solution of Chloride of Gold	2 drachms.

The Collodion does not acquire its greatest degree of sensitiveness until it has become of a pale straw colour. The addition of Anhydrous Carbonate of Soda, in the proportion of one drachm to eight ounces of Collodion, will hasten this change.

Great care must be taken not to use an overdose of gold. To ascertain whether it be in excess or not, coat a plate, expose under a negative to gas or candle-light, and develop with pyro-gallic acid. If the plate become brown all over, or shew reddish stains, especially at the edges of the plate, there is too much gold present; but if it develop clearly and well—let well alone.

I may mention, by the way, that during my researches, the greater part of the preliminary experiments were performed simply by the aid of artificial light, and it was only when the method under investigation gave some promise of success, that I operated with it out of doors. It will

consequently be seen that it is quite possible to become almost perfect in the process without once practising in the open air. The plates can be coated, sensitised, and dried, exposed under a negative or a transparent positive, to either gas or candle light, developed, fixed, and finally varnished, without the necessity of leaving one's fireside; moreover, the failures (which every learner must expect,) will not be attended with as much trouble and expense as if every plate were to be carried into the field, and at the same time, a knowledge of the manipulation will be as readily acquired in the one case, as in the other. I should therefore recommend Photographers to learn and practise the process during the winter months so as to be in readiness for out-door operations in the spring.

When large plates are to be coated (and especially when the views to be taken comprise extensive sheets of water) use a thick, but slightly iodized, Collodion. Thomas's negative Collodion, when mixed in equal proportions with the prepared Collodion for dry plates, answers admirably for large surfaces of water.

A thick Collodion is recommended, inasmuch as a thin coating, being more readily attackable, sometimes yields a negative dotted over with minute holes, which would be rendered very perceptible in the water.

As a general rule it is always well to use a thickish Collodion.

Many specimens of gun paper will dissolve in ether alone, whilst others require the addition of alcohol; this can only be ascertained by actual experiment.

Methylated Ether yields a Collodion much less sensitive than that manufactured with the ordinary description of ether; consequently its use must be avoided. In order to detect it, pour a few drops of the suspected fluid into the palm of the hand and allow it to evaporate; if methylated, a distinct odour of naphtha will be perceived on applying the hand to the nose.

When pyro-gallic acid is used, as directed at page 23, not only is the development of the picture facilitated and shortened, but additional power is given to the resulting negative. During the development, the solution should be kept in motion and be frequently poured on and off the plate; the object being to prevent stains in the negative.

It is desirable, when a new washing bath is made, to add a small portion of nitrate of silver to it; otherwise a few drops of silver solution must be added to the developing fluid.

At page 21, line 7, for the paragraph commencing "but it undergoes," and ending "length of time," read:—"but when a small quantity of Acetic Naphtha has been added to it, in the proportion stated at page 9, it undergoes a somewhat rapid change, acquires finally a pale straw colour, and it will then remain equally sensitive for any length of time."

It is my intention to pursue, still further, my experiments during the winter months; and next spring I hope to be able to bring before the public an entirely new edition of this work, which will contain, besides, papers on the "Wet Collodion," and "Positive Printing" Processes.

LONDON, 64A, NEW BOND STREET. W.
December, 1856.

Western Photographic Institution,

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THE DRY COLLODION PROCESS.

I need scarcely state, that a good knowledge of the Wet Collodion Process is essentially necessary to those who would successfully practise the Dry—a fact not to be overlooked by those who wish to obtain good results. Such being the case, it will be needless for me to enter into any elementary details of the ordinary manner of coating the plates, &c., and I shall therefore be enabled to devote the whole of these pages to the description of the method of working with Dry Collodion.

APPARATUS, ETC.

The only pieces of apparatus required to be added to the ordinary stock of an operator in the Wet Collodion Process, are a vertical gutta-percha bath, of a size suitable for the plates he intends to work with, and a Drying Box, a description of which is given at page 12.

The glass plates used must be ground on the surface, $\frac{1}{4}$ in. all round, on that side on which the collodion is to be applied.

PREPARATION OF THE COLLODION.

As success in this process depends almost entirely upon the collodion, the formula given for its preparation must be strictly adhered to, and the greatest care should be taken to employ the purest chemicals in its manufacture.

The following solutions must first be made. As they do not injure by keeping, a stock of them may be safely mixed:—

TINCTURE OF IODINE.

Re-sublimed Iodine ... ... 2 drachms.

Absolute Alcohol ... ... 2 ounces.

When dissolved, add

Anhydrous Carbonate of Soda... 2 drachms.

The Carbonate of Soda may always remain at the bottom of the stock bottle, and the quantity of Tincture required for use should be carefully poured, or filtered, off as it is wanted.

ETHERIAL TINCTURE OF CHLORIDE OF GOLD.

Chloride of Gold ... ... 10 grains.

Washed Ether .. .. 1 drachm.

Dissolve, and preserve in a well-stoppered bottle.

SOLUTION OF IODIDE OF POTASSIUM.

Iodide of Potassium ... ... 32 grains.

Absolute Alcohol ... ... 2 ounces.

Dissolve, and preserve in a well stoppered bottle.

PLAIN COLLODION.

Gun Paper	2 drachms.
Washed Ether...	1 pint.

Dissolve, and decant if requisite.

If the ether should not dissolve the whole of the gun paper, decant the supernatant clear solution into a clean and dry stoppered bottle. I find gun *paper* is the best adapted for the Dry Process, gun cotton proving very treacherous in my hands.

The following formula I have found the most successful one; those, however, who would like to vary their experiments, are referred to page 22, where they will find the results of a few of the numerous trials I have made.

IODIZED COLLODION.

Plain Collodion	4 ounces.
Solution of Iodide of Potassium	5 drachms.
Pyro-acetic Spirit, purified ... (Pure wood naphtha)	4 drachms.
Camphor	4 grains.
Etherial Tincture of Chloride of Gold	10 drops.
Tincture of Iodine	½ drachm.

The ingredients having been added to the plain collodion in the

order above given, let them be well shaken up, and when the camphor has dissolved, the whole should be allowed to settle.

I should advise operators to iodize at least one pint at a time, as I find the collodion is greatly improved after the lapse of eight or ten weeks.

Especial care should be taken to reserve a small quantity of old collodion to add to the freshly iodized ; by this addition it is prevented from disconnecting itself from the glass in drying, when large plates are used.

If the collodion is required to be used in a day or two after it has been iodized, the addition of the old collodion should be made in the proportion of one ounce of the old to four ounces of the new. Most operators possess, generally speaking, a stock of old waste collodion. As this old collodion is admirably adapted for the purpose above mentioned, I have given in the appendix, at page 29, directions for restoring and de-colorizing it, and rendering it again available.

SENSITISING THE PLATE.

The glass plate having been carefully cleaned, the collodion is applied in the usual way, and dipped in the following

NITRATE OF SILVER BATH.

Solution No. 1.

Nitrate of Silver ... ... $1\frac{1}{2}$ ounce.

Distilled Water... ... ... 4 ounces.

Dissolve,

Solution No. 2.

Iodide of Potassium ... ... 6 grains.

Distilled Water ... ... 1 ounce.

Dissolve.

Mix the two solutions by rapidly pouring the iodide of potassium into the silver; then add fifteen ounces more of distilled water. By this addition, iodide of silver will be thrown down in such an extremely divided state, as to render it easily soluble in the bath. Allow the whole to stand in a warm situation for forty-eight hours, occasionally shaking the bottle containing it. After the lapse of that period, add 1 ounce of Alcohol to the solution, filter it into a dipping bath, and immerse in it a *wet* collodionized plate, of the size of $6\frac{1}{2}$ in. by $8\frac{1}{2}$ in. Add newly-coated [wet] collodionized plates two or three times in the course of about forty-eight hours: by that time the bath will be saturated with iodide of silver, and will not attack the plates that are afterwards made sensitive in it. It is advisable to keep this bath exclusively for the use of collodion, the formula for which has just been given. One reason for it is, that by use the bath (especially if it contain a large proportion of alcohol) becomes saturated with camphor, and such being the case, on developing with pyro-gallic acid alone, in the wet process, the plate is blackened all over.

Many failures, especially with beginners, arise solely from the

fact of various differently constituted collodions being used with one bath; an endless variety of compounds are thus formed in it, and consequently it very soon gets out of order.

When the bath flows evenly over the surface of the plate, remove it from the dipper, and allow it to drain on a little bibulous paper for a couple of minutes; then immerse it in a vertical bath containing distilled water, and agitate the plate for about two minutes; the plate must afterwards be well washed with common water, and finally a little distilled water is to be poured over it. The object of these washings is to free the plate from every trace of nitrate of silver, the presence of which would give rise to specks and stains in the negative.

DRYING THE PLATES.

After standing on bibulous paper to drain off the greater part of the water, they must be put aside to dry, in a place free from dust. The plates, especially in cold weather, take a long time (sometimes a day) to dry, owing to the camphor present in the collodion. This is a great drawback when the plates are required to be prepared in a hurry. I have therefore contrived a drying box, to meet such cases, and which I will describe. The box must of course be made to suit the size of the plates operated with. In the following description it is intended for plates 10 in. by 12 in. and under. Make a box, 2 feet long, 12 inches wide, and 14 inches high, inside measurement. Let one side of it slide in

a groove, so as to enable the plates to be placed in it. Let the bottom of the box be formed of slips of wood, one inch wide, $\frac{1}{4}$ inch thick, and about one inch apart, extending from end to end; under these, and forming the outside covering of the bottom, is an iron plate, by means of which, and the aid of a spirit lamp, heat can be conveyed to the plates contained in the interior of the box. At the top an aperture must be made, to allow the moisture to escape. When in use, this should be covered with a piece of fine muslin, to prevent the entrance of any flying particles of dust; at all other times it should be closed with a suitable lid. In the interior of the box, and running down the centre of it, slips of wood, $1\frac{1}{2}$ inch wide, and $\frac{1}{4}$ inch thick, must be fixed nearly perpendicularly, and at such a distance from each other, that when the plates to be dried touch the top of one of the uprights, and the bottom of the adjoining one, they shall incline at an angle of about 10°.

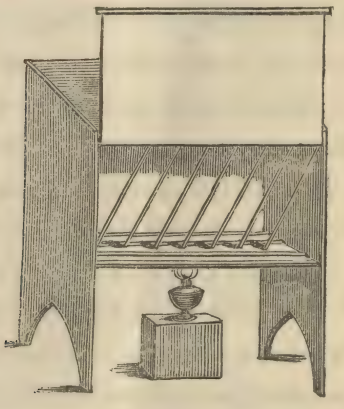
Care must be taken that the plates do not touch the wood anywhere but at their extreme edges, otherwise the collodion is liable to dry unevenly. The temperature at which the plates are dessicated should not be much above 60° Fahr. When old collodion is employed the temperature is not of such importance as when a newly iodized batch is operated with; in the latter case, and with large plates, the film is very liable to crack and curl up if a greater degree of heat is applied.

If all the foregoing directions have been carefully attended to,

the coating of collodion will be nearly transparent, clear, and perfectly structureless, and will retain an uniform sensitiveness for a fortnight or three weeks, or even for a longer period.

The plates may afterwards be placed in an ordinary plate box; great care being taken to exclude all white light from them.

DRYING BOX.



EXPOSING THE PLATES.

The time of exposure in a clear bright light, when all is in proper order, with a Lerebours three inch single achromatic lens, and one inch diaphragm, is about two minutes. I have not found that the sensitiveness has been impaired by keeping; in fact, on one occasion, I prepared several plates, some of which were exposed on the following day, and the remainder I was unable to use

until six weeks had elapsed. I found these latter quite as rapid in their action as the former; thus affording me a conclusive proof of the keeping qualities of the collodion. On both occasions the same lens was employed, and the light was of the same degree of intensity. I should, however, recommend beginners not to keep them more than a week before being exposed.

With a double combination lens, in a glass room, I have obtained very fine negative portraits in 50 seconds. I have hitherto confined my experiments to the production of a collodion suitable for landscapes only, but I have, in the course of these trials, seen sufficient indications to convince me that it is far from impossible to obtain a collodion which, when dessicated, shall be as sensitive as any of those used in the wet process.

DEVELOPING THE PICTURE.

The plate, on being removed from the slide, must be immersed for about a minute in the washing bath, and afterwards placed on the levelling stand; then flood the plate with a sufficient quantity of the following solution :—

Saturated solution of Gallic Acid	4 ounces
Distilled Water	4 ounces.
Acetic Acid...	1 drachm.
Pyro-gallic Acid...	4 grains.
30 gr. Solution of Nitrate of Silver	10 drops.

Dissolve, and filter if requisite.

If time is no object, gallic acid and nitrate of silver alone may be used; the time of developing ranging from ten minutes to one hour.

If over exposed, the film assumes a greenish tint during the development, and, consequently, does not print as rapidly as when the proper amount of exposure has been given.

FIXING THE PICTURE.

When the picture is well developed, fix with a solution of eight ounces of hypo-sulphite of soda dissolved in one pint of water, and then well wash the plate with an abundance of water.

It is a great improvement to add about one drachm of cyanide of potassium to the solution of hypo-sulphite of soda just described. By its use the undecomposed iodide of silver is more rapidly cleared off, and the resulting picture is much cleaner than when hypo-sulphite of soda alone is employed.

The plates must be allowed to dry spontaneously in a warm situation. The greatest care must be taken to prevent any draughts in the operating room, as they are liable to make the collodion crack while drying; it is, therefore, always advisable, even in hot weather, to place the plates in the drying box described at page 12. When perfectly dry, varnish with amber and chloroform varnish, or with any other varnish which does not require the plate to be warmed previous to, or after, its application.

A very pleasing application of the dry collodion, is to the

preparation of transparent positive slides for the magic lantern. Negative [the same] collodion is to be employed for the purpose of producing positive pictures ; the time of exposure in the sun is from one to five seconds.

I may remind the operator that it is not essential that the plates should be developed the same day ; this may be left till convenient. Sometimes I have kept them six and eight days after exposure, and have obtained in every case first-rate results.

Confirmative Experiments, &c. on the use of Camphor, Acetic Naphtha, Alcohol, Acetic Acid, Iodine, Chloride of Gold, &c.

Having described the easiest way of producing negatives on dried collodion—that which is most calculated to succeed in the hands of the majority—I will now proceed to give my reasons for employing the different chemicals whose use I recommend, to enter slightly into the details of other very successful, though more difficult, processes, and, at the same time, to draw the attention of the operator to a few interesting facts eliminated during the course of my experiments.

CAMPHOR.

In 1854 I made numerous experiments with camphor, believing

it had preservative qualities; amongst other methods, I tried the following:—I coated a plate one evening, excited it in a nitrate of silver bath in the ordinary way, and thoroughly washed it with distilled water to ensure its being free from nitrate of silver. I then immersed it in a camphorated bath, made by placing an excess of pulverized camphor in distilled water, and allowing it to stay until the water had become saturated with it.

The iodized plate was allowed to remain in the camphorated bath until required for use, the time being, in this case, forty-eight hours; it was then removed, drained, placed in the camera slide, and exposed to light. The plate did not seem to have become less sensitive by its sojourn in the camphor bath, but the picture produced was not clean, presenting the appearance of a collodionized plate prepared in an alcaline bath. This I attribute to the camphor not having been washed away from the plate, and also to my using pyro-gallic acid as a developing agent. The picture should have been developed with gallic acid alone, as when camphor in excess, and pyro-gallic acid, come in contact with each other on the plate, the latter is blackened all over.

Supposing, therefore, there is more than $1\frac{1}{2}$ grain (the maximum quantity) of camphor to each ounce of collodion, it would be impossible to develop with pyro-gallic acid, and gallic acid must then be employed alone.

The proportion of camphor should not be more than from 1 grain to $1\frac{1}{2}$ grain to the ounce of collodion. The advantages to

be derived from its use are the following :—It gives additional power to the negative—it renders the collodion less liable to disconnect itself from the glass plate—it prevents the collodionized plate from drying too quickly; and affords the operator, when used for the wet process, more time between the exposure and the development of the picture.

ALCOHOL, ACETIC ACID, AND ACETIC NAPHTHA.

I find, from experiment, that it is impossible to obtain a collodion, suitable for plates of a large size, if ether and alcohol alone be used in its manufacture ; the reason is, that alcohol cannot be employed in such a proportion as to render the resulting collodion non-contractile. I therefore add acetic naphtha, which equalizes the collodion, and renders it uniform when the plate is coated. Acetic naphtha is preferable by far to alcohol, as about $\frac{1}{2}$ an ounce of the former only is required to obtain the same result as would be attained by 1 ounce of the latter. The collodion is also rendered perfectly structureless by its use.

Should, perchance, too much naphtha be added to the collodion, stellar-like marks or ridges will appear upon the plate ; and if, through under exposure, the time of development has to be prolonged, the number of them will be greatly increased.

These marks are due to the expansive properties of acetic naphtha, and the remedy for them is simply the addition of a little fresh collodion.

Acetic acid expands the collodion ; for this reason I add acetic acid to the gallic acid developing solution. Gallic acid alone tans, as it were, the collodion film, and renders it tough and contractile.

IODINE.

I have found this article most useful in giving power to the negative; but it should not be used without neutralizing the acid with which it is sometimes contaminated, otherwise it would considerably interfere with the sensitiveness of the collodion. The readiest way of depriving the iodine of its acidity, is to add to the alcoholic solution of it a small quantity of anhydrous carbonate of soda ; this salt not only renders the solution perfectly neutral, but also possesses the property of absorbing and separating any water that may possibly be present in the alcohol.

After making numerous experiments with various chemicals, chlorides, bromides, iodides, &c., I have arrived at the conclusion that the best sensitive solution is the following:—

Absolute Alcohol ... ... 2 ounces.

Iodide of Potassium ... ... 32 grains.

Dissolve without the use of heat, and filter if necessary.

This solution is added to the plain collodion in the proportion of 2 drachms of the former to 6 drachms of the latter, there being 2 grains of iodide of potassium to each ounce of collodion. The other chemicals mentioned in the formula are added after the

above, care being taken to use a sufficient quantity of the solution of sublimed iodine, divested of its acidity by carbonate of soda, to tinge the collodion with a sherry colour.

The action of sublimed iodine upon the collodion is somewhat remarkable, inasmuch as the reddish tone imparted to the collodion by its addition to it is not retained permanently, as one would imagine; but it undergoes a somewhat rapid change, and acquires finally a pale straw colour, and when a small quantity of acetic naphtha has been added to it, in the proportion stated at page 9, it will remain equally sensitive for any length of time.

CHLORIDE OF GOLD.

It is perfectly optional with the operator to use or to reject the chloride of gold given in the formula.

I have employed it with a view to obtain greater power and increased sensitiveness. It should be added in exceedingly small quantities. It is a very deliquescent salt, and is, therefore, best kept in solution. For that purpose I dissolve 10 grains of chloride of gold in 1 drachm of washed ether, and as with these proportions there is 1 grain of the chloride in every 6 drops of solution, it is very easy to measure off the requisite quantity, and add to it the collodion.

In the formula at page 9 I have given the maximum quantity that should be used; any further increase would have the effect of blackening the plate all over in the nitrate bath. In any case,

however, the difficulties of manipulation are heightened by the use of this salt.

It is indispensible to obtain the chloride of gold as free as possible from acid ; due precaution should also be used in its purchase, as much of this salt offered for sale is very impure.

ALBUMEN.

A combination of albumen and collodion will be found exceedingly useful, especially in cases when it is desirable to keep the plates sensitive for six or eight weeks, or even for longer periods. The albumen must be diluted as follows:—

White of Egg ... ... 2 ounces.
Distilled Water ... ... 12 ounces.

Beat it up until the whole is converted into a white froth ; allow it to stand in a cool place for twenty-four hours, and filter through bibulous paper or fine muslin.

Having excited your plate, and thoroughly freed it from nitrate of silver, as described at page 12, place it on a levelling stand, and pour over it a sufficient quantity of the above albumen to cover it entirely. At the end of a quarter of an hour or twenty minutes pour off the albumen ; let the plate drain for a few minutes, and place it in the drying box described at page 12. This slight coating of albumen tends wonderfully to preserve the sensitiveness of the plate; but it requires more careful manipulation

in its application, and, besides, takes up a great deal more time than by the use of collodion only.

The development of the picture may be rendered more rapid by the addition to the albumen solution of 24 grains of pyro-gallic acid and $1\frac{1}{2}$ drachm of acetic acid, mixed with $\frac{1}{2}$ an ounce of distilled water. If this addition be made, it will not be necessary to leave the albumen upon the plate more than five minutes; during the development the picture must be closely watched.

AMBER VARNISH.

The glass plates may, in the first place, be coated with amber and chloroform varnish, and then with collodion. This has the effect of making the plate more sensitive, and, in my hands, has been successful with plates 10 in. by 12 in.

INDIA-RUBBER AND BENZOLE.

India-rubber is a useful adjunct in the preparation of dry plates. The following details of the method of application will be found extremely advantageous, especially by young hands, and in cases where large surfaces are to be covered.

The india-rubber, with which the solution is prepared, should be in the unmanufactured, or crude, state. I generally select good bottle rubber, and having separated the inner portion, or that which is of a light cream colour, reject the darker part. Having cut it into small pieces, I place a $\frac{1}{4}$ of an ounce of it in

a wide-mouthed stoppered bottle, and pour over it 10 ounces of purified benzole. After the lapse of about forty-eight hours it will be found that the whole of the rubber is dissolved. The clear portion of the solution must be decanted off, and the fluid is then ready for immediate use. It should be of such a consistence as to flow very readily over the plate, and to give, when dry, a thin transparent coating, closely similar in appearance to albumen.

The solution is poured on in the same way in every respect as collodion ; is allowed to remain on the plate a shorter or longer period, according as the weather is warm or cold; is returned to the bottle, care being taken not to raise the plate too rapidly ; allowed to drain until it begins to set; and is finally dried off, either by holding it before a gentle fire, or, which is preferable, applying a moderate heat by means of a spirit lamp. The plate being held in a vertical position, commence drying the plate at the corner opposite to that by which the fluid is poured off, so as to prevent the film from becoming too thin at that end of it. It is unnecessary that the glass plate, intended to be coated in this manner, be ground at the surface as directed at page 7. Sulphuric ether being a solvent, although but in a slight degree, of india-rubber, the collodion, on being poured on the plate, amalgamates with the dessicated film, forming one and and the same substance, and it is impossible to separate them afterwards. It possesses all the stability of albumen, and produces a negative in four minutes. Plates prepared in this way will bear any reasonable amount of

rough usage; in fact, it is almost impossible to remove the film from the plate, except by actual hard rubbing.

India-rubber possesses this advantage over all other processes, viz: that almost any collodion may be used, provided always, that acetic naphtha be not present in it. Instead of benzole, chloroform may be employed as a solvent for the india-rubber, and in one respect it is a very good substitute, as it evaporates quickly without the use of heat ; but its great expense debars its use, except under rare circumstances, where sources of heat cannot readily be procured. The reader may naturally enquire, 'Could he not take pictures directly with this solution without the intermediate use of collodion?' To this I can, to a certain extent, give a satisfactory answer. I have iodized the solution, and produced very good pictures with it, but its action is exceedingly slow ; much more so than albumen.

COLLODION WITH ALBUMEN.

Albumen can be substituted for the solution of india-rubber and benzole. It is especially convenient for travellers, who will find it often as difficult to procure india-rubber and benzole, as it is easy to obtain freshly-laid eggs. This I can vouch for with confidence, having had much experience during a ten years' sojourn in various parts of the world. As it is only necessary to have a very slight coating of albumen upon the plate, the difficulty of applying it is not so great as one might imagine.

The glass plates need not be ground on the surface as for dry collodion, but merely have the extreme sharp edges taken off. The glass plate must be well cleaned with alcohol, and, if of a large size, placed on a pneumatic, or other plate holder. The form of holder I prefer, is one easily manufactured by the operator himself, and is constructed as follows :—

Take a flat circular piece of wood, or metal, about 3 inches in diameter, and $\frac{1}{2}$ an inch thick, and fix to the underneath surface of it a knob or handle to hold it by ; then get a piece of gutta percha, of the same diameter and thickness ; pierce a hole in the centre of it, through which pass a screw, which must be screwed into the centre of the wood just mentioned. The gutta percha should not be pressed in very close contact with the wood, but should revolve freely round the screw. When required for use, about half, or less, of the surface of the gutta percha is softened, by exposing it to the flame of a gas burner, and then pressed against the glass plate intended to be coated ; when cooled, the plate may be held in any position without the slightest chance of its falling off. The albumen solution (the formula for which is given at page 28,) is poured upon the plate, facilitating the spreading of it by the use of a glass rod; this last operation is not always required, the albumen generally flowing very readily. When the whole of the surface of the plate is covered, incline it slightly, so as to allow the surplus solution to run off ; the bottle into which it is returned should be supplied with a funnel, as the albumen often

runs off the plate at half-a-dozen places at once, and much of it is lost. Let the plate drain for about one minute, and then hold the back of it to the fire, first warming the upper corner of the plate. As soon as it begins to steam, the temperature must be lowered, by withdrawing it to a greater distance from the source of heat. The plate must then be allowed to dry slowly, as too great a degree of heat would render the albumen liable to crack all over. As soon as the plate has cooled, coat with collodion; wash, and dry, as previously directed at page 12.

These albumenized plates may, if desirable, be stored away in plate boxes, and the coating of collodion be only applied as the plates are required for use. In this case the plates, before coating with collodion, must be warmed, to drive off any moisture they may have acquired. It is also desirable to mark the plain side of the plate, by gumming on it a piece of paper ; the apparent difference between the two sides being so very slight, as to render it difficult quickly to determine which is the albumenized surface.

If at any time, through a continuance of unfavourable weather, or other causes, it will have been found impossible to expose plates that have been prepared for six weeks or more, their sensitiveness may be restored by enclosing them iu a plate box, at the bottom of which half-a-dozen drops of chloroform have been placed, and in which they may remain until wanted.

The albumen process just described is preferable to that with

india-rubber, from the superior facility of its manipulation, and its freedom from objectionable odours.

The albumen solution is made by beating up 4 ounces of albumen from newly laid eggs, with eight ounces of distilled water, allowing the mixture to stand for a few hours, and then pouring off the clear fluid, which should be used within twenty-four hours.

PRACTICAL HINTS, &c.

Under this head, I intend giving details of the results of a few experiments made during my researches on Dry Collodion, and which may be of service to the operator.

In order, if possible, to give increased rapidity to the collodionized plates, I have washed them (after being made sensitive and well washed with distilled water) with different developing solutions, and have noticed the following results:—

Pyro-gallic acid does not seem either to increase or to diminish the sensitiveness of the plate in the slightest manner; proto-sulphate of iron retards considerably the action of the light, and gallic acid possesses the same property, and in the same degree.

Plates that have been treated in this manner, develope more rapidly than when used in the ordinary way; but they require careful manipulation, as they are very liable to become stained and spotty.

It frequently happens that whilst making experiments in pursuit of one object, we are led to the discovery of others, sometimes of more importance than the original one. In this way, I believe I have discovered a new method, by means of which old collodion may be decolorized, divested of its acidity, and restored to its original sensitiveness. The way I proceed is as follows:—

Take any quantity of old collodion, say 16 ounces, and add to it 1 ounce of anhydrous carbonate of soda, and about 4 drachms of acetic naphtha; shake the mixture occasionally until decolorized, which will take place in about a couple of days: less naphtha will suffice, but it will take longer to decolorize. I should, however, advise the operator, as a general rule, to use less, especially if the collodion which has to be decolorized is not very old. In that case a very small quantity of naphtha will do. The operator will not find any disagreeable odour arise from the naphtha contained in this collodion, the quantity being so very small as to render it scarcely perceptible.

This method is far preferable to that in which metallic silver is used as a decolorizer; it does not over-do what it is intended to accomplish; besides, the carbonate of soda absorbs any water

that may be present in the collodion, rendering it perfectly structureless. When the collodion has changed to a pale straw colour, the supernatant clear fluid may be poured off for use, or may be allowed to remain in contact with the carbonate of soda until required. In any case, after it has been treated in the way I describe, no further change will take place in its colour, and it will retain its sensitiveness uniformly for any period. This restored collodion is principally used to add to that which is intended for the preparation of dry plates, as directed at page 10.

When collodion, containing simply ether and alcohol, has only been iodized a few days, and has become reddish and less sensitive, the addition of 30 drops of pyro-acetic spirit to each ounce of such collodion will restore its sensitiveness, and prevent any further change in its composition.

During the course of my photographic experience, many nitrate of silver baths, that had been used for exciting collodion plates, have been placed in my hands to determine the reason they could not be made to produce a sensitive plate. In the majority of cases I found that acetic acid had been added to the bath, generally in excess, and on the addition of ammonia, to neutralize the acid, acetate of silver was immediately formed, thus weakening the bath to a considerable extent.

To evaporate the liquid would involve much time and trouble; instead, therefore, of using ammonia, I employ well-washed kaolin, in the proportion of about 2 ounces to a quart (40 ounces) of

solution, the whole to be well shaken, allowed to stand to settle, the clear fluid poured off, and the remainder filtered through bibulous paper. This is decidedly the best and readiest method of cleansing and decolorizing old baths, and rendering them again available for producing sensitive plates. In this way do I treat the bath I employ for sensitizing dry plates, when it has become discoloured by use. Kaolin possesses a great advantage in another respect, inasmuch as it has the property of making the collodion film adhere more firmly to the glass plate ; thus producing an effect similar to that caused by proto-sulphate of iron.

*** Since writing the preceeding pages, the Photographic Exhibition has been opened, and, for want of space, only a single specimen of a picture taken by the Dry Process was exhibited.

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*** The Glass Operating Room attached to the Establishment of Messrs. G. KNIGHT & Co., Foster Lane, having been kindly placed at the service of the Author; he will be happy to give Practical Instructions, in the various processes described in the preceding pages, to those gentlemen who may favour him with their patronage.

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